H04M 1/06

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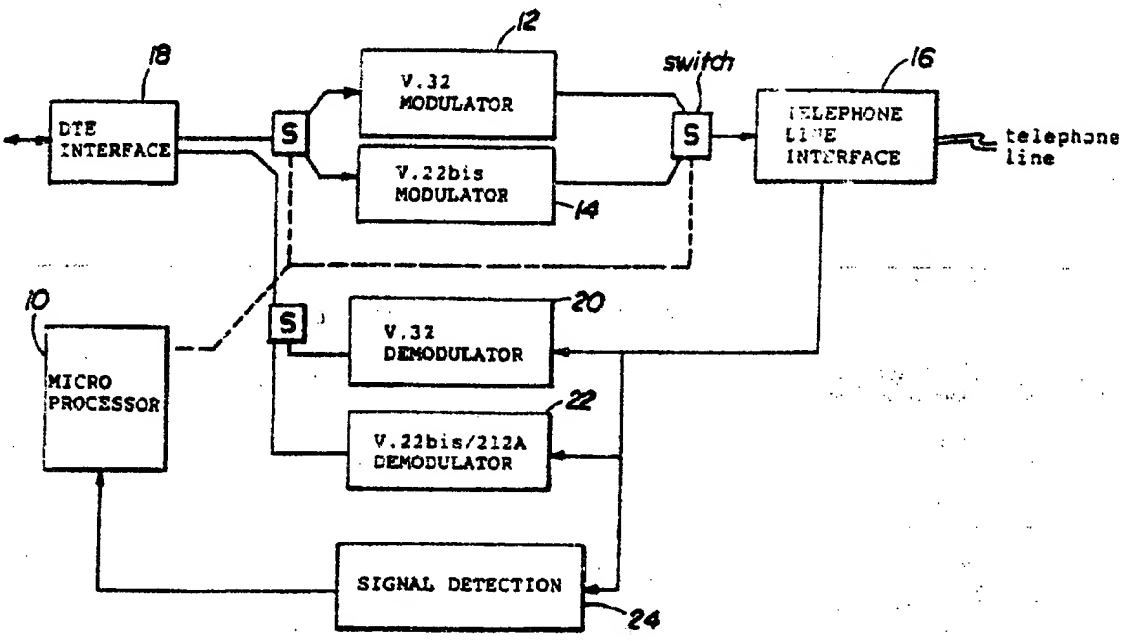
With international search report.

DOC

(54) Title: MULTIMODE MODEM



(57) Abstract

A multimode modem for communicating with a variety of modem types employing differing initial handshake signals includes plural modulators (12, 14) which send a sequence of signals corresponding to the variety of modem type handshake signals, the sequence terminating when a handshake signal detector (24) receives an appropriate response identifying a particular one of the modem types. In a preferred embodiment, the multimode modem (10, 12, 14, 16, 18, 20, 22, 24) is adapted to interwork with V.32 and V.22bis and V.22 modems on the public switched telephone network.

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INTERNATIONAL SEARCH REPORT

International Application No: PCT/US89/02017

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [4]

According to International Patent Classification (IPC) or to both National Classification and IPC

INT CL 4 H04B 1/38

U.S. CL 375/8

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
U.S.	375/ 7, 8, 9, 13, 36, 39, 121 ; 379/93, 97, 98 370/24, 31, 41, 43, 79, 110 ; 178/2R, 3

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X Y	US, A, 4,215,243 (Maxwell) 29 July 1980 See column 4, line 34 - column 6, line 10	1, 4 2, 3
Y	US, A, 4,262,360 (Bigo) 14 April 1981 See column 3, lines 10-21	2, 3
A	U S, A, 4,727,370 (Shih) 23 February 1988	
A,P	U S, A, 4,756,007 (Oureshi) 05 July 1988	

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

31 July 1989

Date of Mailing of this International Search Report

29 AUG 1989

International Searching Authority

ISA/US

Signature of Authorized Officer

Benedict V. Safourek

Form PCT/ISA/210 (second sheet) (Rev.11-87)

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

V ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1 ☐ Claim numbers . because they relate to subject matter [2] not required to be searched by this Authority, namely:

2 ☐ Claim numbers . because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out [3], specifically:

3 ☐ Claim numbers_____, because they are dependent claims not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [4]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4 ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.

MULTIMODE MODEM

Background of the Invention

This invention relates to multimode modems.

It is desirable for a modem to be able to interwork with V.32 and with V.22bis and V.22 modems on the public switched telephone network. It is also desirable that the modem automatically select the data rate and mode in which to operate. Further, any interworking procedure of the multimode modem should be compatible with various implementations of both standards.

An interworking procedure has been described which, for the multimode answer modem, involved sending the initial tone for the V.32 procedure (AC) and the initial tone for the V.22bis procedure (UNSCR1 at 1200 bps) simultaneously. See, "A Proposed Appendix to Recommendation V.32: Interworking Procedure With V.22bis and V.32 Modems", delayed contribution to D-30 to CCITT Study Group XVII, April 1986.

As described in this D-30 document, handshaking tones for both V.32 and V.22bis modulation modes are transmitted; because the total power is restricted, the tones for each modulation method are less powerful than the normal single-mode interworking. This power restriction poses a potential problem after a multimode modem has detected the modulation method of the other modem and needs to remove the other tones and increase the power of the correct signalling tones. A modem designed to V.22bis or V.32 and not to operation with a multimode procedure as described in the D-30 document might not operate properly through this transition. Further, a modem constructed to conform only to V.32, might not reject the additional tones used by a

multimode modem to sense for a V.22bis modulation mode. As such, there is a possibility that a multimode modem built upon the algorithm described in the document D-30 might not operate with some implementations of V.32.

Summary of the Invention

The multimode modem according to the invention for communicating with a variety of modem types employing differing initial handshake signals includes a multimode modem which sends a sequence of signals corresponding to the variety of modem type handshake signals, the sequence terminating when the multimode modem receives an appropriate response identifying a particular one of the variety of modem types. In a preferred embodiment, the multimode modem is adapted to interwork with V.32 and V.22bis and V.22 modems on the public switched telephone network.

The multimode modem of the invention utilizes a sequential technique to detect the modulation method of another modem with which to communicate. This technique defines an initial operating procedure in which the initial tones of the V.32 and then V.22bis standards are tried sequentially instead of simultaneously (or in parallel) as described in the D-30 document. The training procedure, after first seeing the initial tone, will meet the respective modem standards and thus will be much more robust to the method of implementation of the respective single mode modems. Furthermore, the sequential technique of the present invention may be more accurate than the parallel algorithm described in the D-30 document. This procedure can also be used after the initial connection to change the operating modes from the current mode to one of the other modes it is capable of supporting.

Brief Description of the Drawing

Fig. 1 is a block diagram of the multimode modem disclosed herein;

Fig. 2 is a block diagram of the signal detection block of Fig. 1;

Figs. 3a and 3b are schematic illustrations of a multimode call training sequence according to the invention; and

Figs. 4a and 4b illustrate multimode answer training sequences.

Description of the Preferred Embodiment

The present invention is a modification of a single mode V.32 Model 2260 modem manufactured by the Codex Corporation of Canton, Massachusetts. This modem includes a microprocessor chip, Model 6809 manufactured by the Motorola Corporation. The software driving this microprocessor was modified in the implementation of the preferred embodiment of the present invention.

The multimode modem of the invention incorporating both V.32 and V.22bis modes of operation can interwork at 9600 and 4800 bits per second with a V.32 modem and at 2400 and 1200 bits per second with a V.22bis modem and at 1200 bits per second with a V.22/212a modem, automatically selecting the correct mode.

The multimode modem of the invention is shown in Fig. 1. A microprocessor 10 controls the functionality of the other blocks. The microprocessor 10 selects either a V.32 modulator 12 or a V.22bis modulator 14 to connect to a telephone line interface 16 and to a DTE interface 18. The microprocessor 10 also selects which of demodulators 20 and 22 to use on the input signal and to connect to the DTE interface 18. The signal detection apparatus 24 provides information

to the microprocessor 10 as to the type of signal being received. The apparatus 24 can determine if any of the following signals are present: 600 Hz and 3000 Hz tones (AC), an 1800 Hz tone (AA), a 2250 Hz tone, a 2225 Hz tone, a V.22bis modulated alternating sequence (SI), a V.22bis modulated scrambled 1's pattern, or if no signal is present, as shown in Fig. 2. The microprocessor 10 selects the type of modulation to be used and the signal to be sent by the modem. As the calling modem it will not activate either modulator until it has determined the mode of operation to follow. The operation of a calling multimode modem will now be described in conjunction with Figs. 3a and 3b. After connecting to a line the multimode modem will initially remain quiet. The multimode modem will be conditioned to detect one or two incoming tones at frequencies of 600 Hertz and 3,000 Hertz and an unscrambled ones V.22bis signal in the high channel (2250 Hertz). If 600 Hertz and/or 3,000 Hertz tones are received from an answering modem, the multimode modem will continue the handshake sequence in accordance with V.32 and commence transmission of a repetitive carrier state AA. If unscrambled ones at 1200 bits/second in the high band (as per V.22bis sections 2.1 and 2.4) is received from the answering modem, then the multimode modem will condition itself for operation in accordance with V.22bis, transmitting in the low band and receiving in the high band. The handshake sequence will be completed in accordance with V.22bis (section 6.3.1.1.1 or 6.3.1.2.1).

As the answer modem, the V.32 initial training sequence is sent first and if there has been no response after a time period, the V.22bis initial training sequence is sent. Since the V.32 signal is the first one sent, two multimlde modems will interwork in the

V.32 mode, which is the highest, and hence the most desirable rate. The operation of an answering multimode modem will now be discussed in conjunction with Figs. 4a and 4b. After connecting to the line, the multimode modem will transmit the recommendation V.25 answer sequence. Then the modem will transmit alternate carrier states A and C. The multimode modem will be conditioned to detect an incoming tone at 1800 Hertz. If the 1800 Hertz tone is received from the calling modem, then the multimode modem will continue the training sequence in accordance with V.22 section 5.4.2. If there has been no signal received after a period of five seconds, then the multimode modem will cease transmitting AC and start to transmit a tone at 2250 Hertz. The multimode modem will be conditioned to detect a V.22bis signal in the low channel as well as a tone at 1800 Hertz. If a low channel signal is received from the calling modem, then the multimode modem will condition itself to receive in the low channel and transmit in the high channel and continue the handshake sequence in accordance with V.22bis (section 6.3.1.1.2 or 6.3.1.2.2). If a tone at 1800 Hertz is received, then the multimode modem will cease transmitting the 2250 Hertz tone and start transmitting alternating carrier states A and C, the multimode modem will attempt to follow the remainder of the V.32 training sequence.

Claims

1. A multimode modem for communicating with a variety of modem types employing different initial handshake signals comprising:

apparatus adapted to send a sequence of signals corresponding to the variety of modem type handshake signals, the sequence terminating when the multimode modem receives an appropriate response identifying a particular one of the variety of modem types; and

apparatus to simultaneously determine the particular type of modem from the received signal.

2. The multimode modem of claim 1 wherein the variety of modem types include V.32 and V.22bis.

3. The multimode modem of claim 2 wherein the V.32 signal is the first one transmitted.

4. The multimode modem of claim 1 wherein the sequence of handshake signals is employed to change operating modes at some time after an initial connection.

Claims

1. A multimode modem for communicating with a variety of modem types employing different initial handshake signals, comprising:

circuitry for sending a sequence of signals corresponding to the variety of modem type handshake signals and for terminating the sequence when the multimode modem receives a response that identifies a particular one of the variety of modem types; and

circuitry for determining the particular type of modem from the received response, said determining being made simultaneously for at least two of said modem types.

2. The multimode modem of claim 1 wherein the variety of modem types include V.32 and V.22bis.

3. The multimode modem of claim 2 where a handshake signal for the V.32 modem type is the first one transmitted.

4. The multimode modem of claim 5 further adapted to cause the sequence of handshake signals to be sent at a predetermined time after said connection is made so that the operating mode of said multimode modem can be changed.

5. The multimode modem of claim 1 wherein said multimode modem is a calling modem and said response that identifies a particular modem type is received from an answering modem, and further comprising

circuitry for causing said multimode modem to establish a connection with said answering modem, and to operate in a mode that corresponds to said particular type of said answering modem.

6. The multimode modem of claim 1 wherein said circuitry for determining determines said particular type of modem simultaneously for all of said modem types.

7. The multimode modem of claim 1 wherein said circuitry for determining determines said particular type of modem simultaneously with said sending of said sequence and receiving said response.

8. The multimode modem of claim 1 wherein said circuitry for determining comprises at least two filters, which correspond to said at least two modem types, that are adapted to simultaneously receive said response, said filters producing output signals that indicate said particular type of modem.

9. A method for operating a multimode modem of the kind that communicates with a variety of modem types employing different initial handshake signals, comprising:

sending a sequence of signals corresponding to the variety of modem type handshake signals and terminating the sequence when the multimode modem receives a response that identifies a particular one of the variety of modem types; and

determining, simultaneously for at least two of said modem types, the particular type of modem from the received response.

10. The method of claim 9 wherein the variety of modem types include V.32 and V.22bis.

11. The method of claim 10 further comprising transmitting a handshake signal for the V.32 modem type before transmitting a handshake signal for the V.22bis modem type.

12. The method of claim 9 wherein said multimode modem is a calling modem and said response that identifies a particular modem type is received from an answering modem, and further comprising

causing said multimode modem to establish a connection with said answering modem, and to operate in a mode that corresponds to said particular type of said answering modem.

13. The method of claim 12 further comprising

causing the sequence of handshake signals to be sent at a predetermined time after said connection is made so that the operating mode of said multimode modem can be changed.

14. The method of claim 9 wherein said determining is made simultaneously for all of said modem types.

15. The method of claim 9 wherein said determining is made simultaneously with said sending of said sequence and receiving said response.

16. The method of claim 9 wherein said determining comprises simultaneously applying said response to at least two filters, which correspond to said at least two modem types, said filters producing output signals that indicate said particular type of modem.

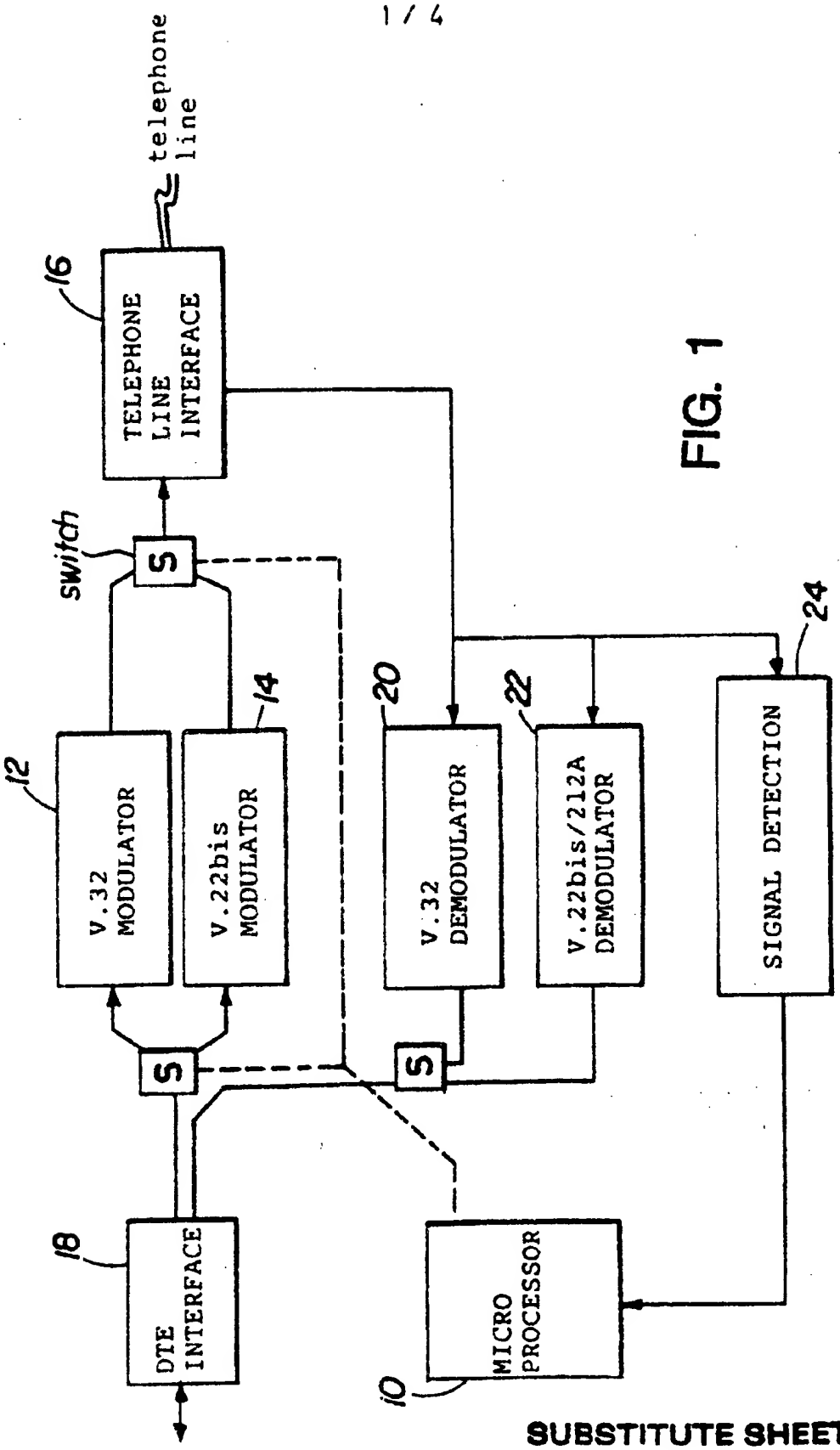
telephone line
16
TELEPHONE LINE INTERFACE
switch
S
12
V.32 MODULATOR
14
V.22bis MODULATOR
20
V.32 DEMODULATOR
22
V.22bis/212A DEMODULATOR
24
SIGNAL DETECTION
S
S
18
DTE INTERFACE
MICRO PROCESSOR
10

FIG. 1

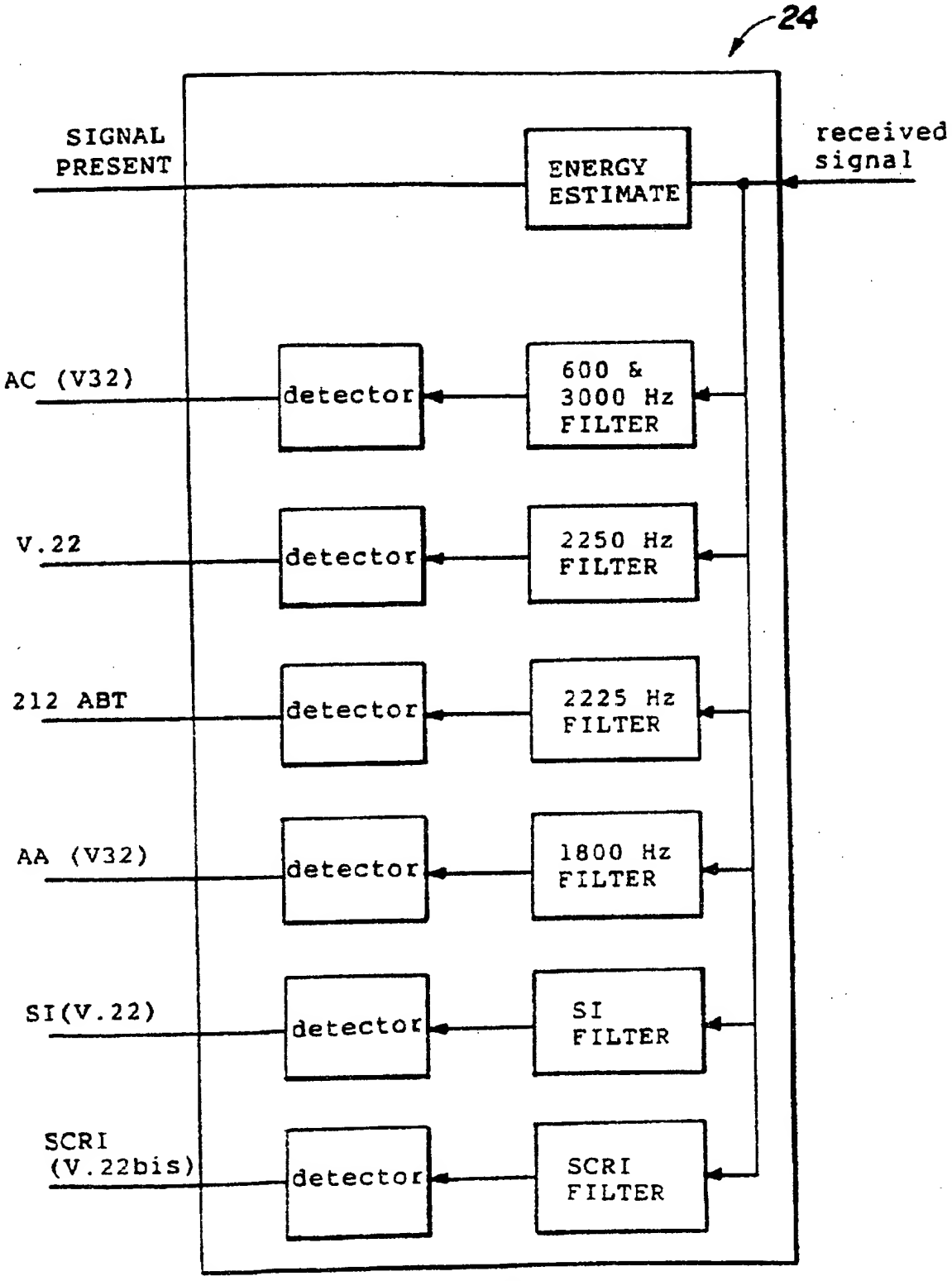
24
SIGNAL PRESENT
ENERGY ESTIMATE
received signal
AC (V32)
detector
600 & 3000 Hz FILTER
V.22
detector
2250 Hz FILTER
212 ABT
detector
2225 Hz FILTER
AA (V32)
detector
1800 Hz FILTER
SI(V.22)
detector
SI FILTER
SCRI (V.22bis)
detector
SCRI FILTER

FIG. 2

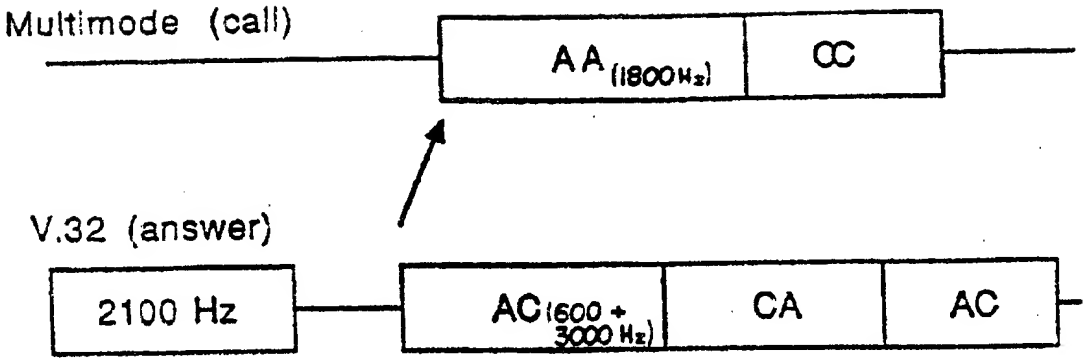
Multimode (call)
AA (1800 Hz)
CC
V.32 (answer)
2100 Hz
AC (1600 + 3000 Hz)
CA
AC

FIG. 3a

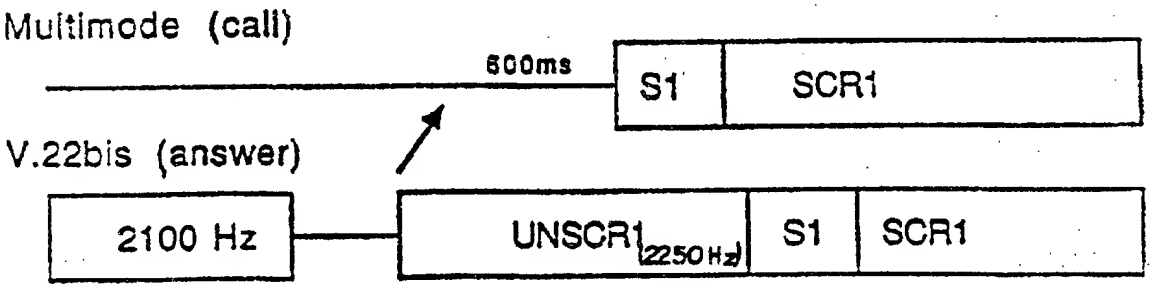
Multimode (call)
600ms
S1
SCR1
V.22bis (answer)
2100 Hz
UNSCR1 (2250 Hz)
S1
SCR1

FIG. 3b

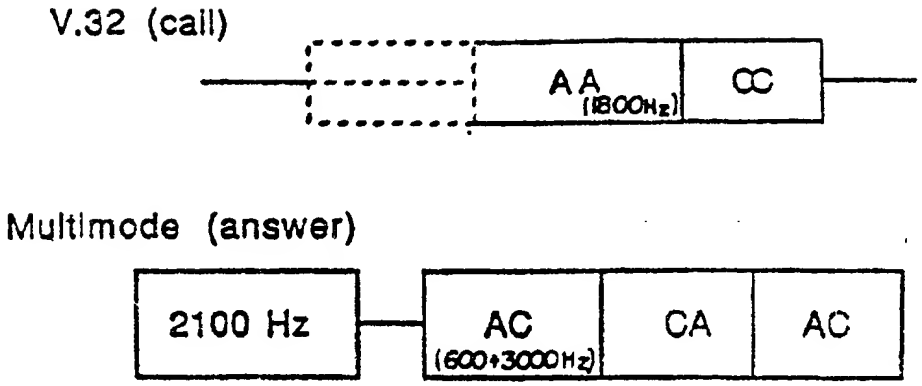
V.32 (call)
AA (1800Hz)
CC
Multimode (answer)
2100 Hz
AC (600+3000Hz)
CA
AC

FIG. 4a

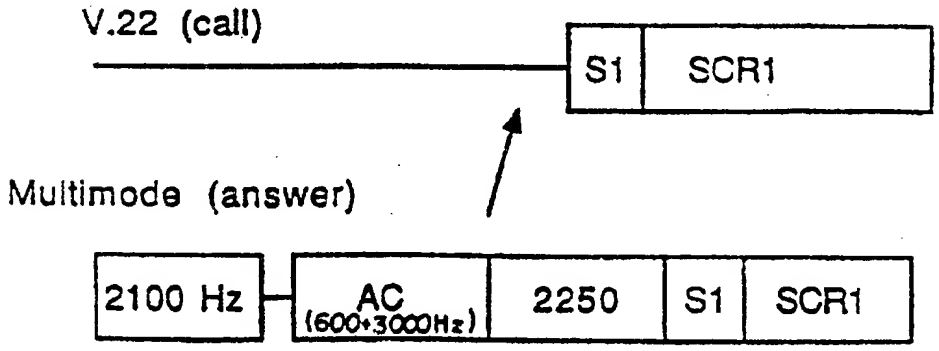
V.22 (call)
S1
SCR1
Multimode (answer)
2100 Hz
AC (600+3000Hz)
2250
S1
SCR1

FIG. 4b

H04M11/06

.. 416 013 .

Application Number

H REPORT

EP 89 90 6560

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X Y A	GB-A-2 194 710 (PRANDINI) * Page 2, line 43 - page 3, line 71 *	1,4-7,9,12-15 2,3,10,11 8,16	H 04 B 1/38
Y	MINI-MICRO SYSTEMS, vol. XX, no. 3, March 1987, pages 121-129, Newton, MA, US; J. VICTOR: "Modems accelerate capabilities" * Page 125, left-hand column, line 22 - right-hand column, line 4 *	2,3,10,11	
A	IDEM	1,9	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

H 04 M
H 04 L

The supplementary search report has been drawn up for the claims attached hereto.

Place of search	Date of completion of the search	Examiner
THE HAGUE	10-06-1992	MIKKELSEN C.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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